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knew, with every chemist, that the determination of the coefficient of condensation is a problem of the highest moment, — a problem which had been neglected in the belief that it did not admit of solution. When, therefore, in 1886, he reached what he regarded as a solution of this insoluble problem, and propounded the theorem that "the volume, not only of gases and vapors, but of all species, whether gaseous, liquid, or solid, is constant, and that the integral weight varies directly as the density," he rejoiced in the conviction that he had realized and expressed one of the great laws of nature, after which he had been groping all his life.

While throughout all his maturer years he pondered over the deeper problems of pure science, he was also actively engaged in practical pursuits. The papers he has written on technical subjects would fill well-nigh as many volumes as his theoretical and purely scientific memoirs.

It is proper to state that this notice has been, in the main, compiled from those which have appeared elsewhere, and especially from the extended biographical sketch read by Mr. James Douglas before the American Institute of Mining Engineers last June, and published in the current volume (XX.) of the Transactions of the Institute.

JOSEPH LOVERING.

PROFESSOR LOVERING was born to humble circumstances at Charlestown, Massachusetts, December 25, 1813, and received his early education in the public schools of that place. His father, a subordinate town officer, was a member of the Harvard Church, then under the pastoral care of the Rev. Dr. James Walker, subsequently Professor in Harvard College and its President. At the public school, young Lovering had proved himself an apt and bright scholar, and this circumstance led to his employment by Dr. Walker as a reader. The prophetic judgment of this wise man, whom Harvard students so soon after learned to respect and honor, recognized in the lad unusual promise, and he not only encouraged him to prepare for college, but also aided him with personal instruction and advanced the money necessary to pay his college expenses, a loan which he was soon able to repay. In 1830 Lovering entered the Sophomore Class at Harvard, and was graduated in due course in 1833. He was a distinguished scholar, standing fourth in a class which furnished six Professors to the Alma Mater and four to other institutions. At the Commencement he delivered the Latin Salutatory Oration, and three years later, when his class were entitled to receive the Master's degree, he delivered the Valedictory Oration, according to the custom of that day.

During the first year after his graduation, Mr. Lovering taught a small private school in Charlestown. In the autumn of 1834 he entered the Divinity School in Cambridge, and remained there two years. During a part of the academical year 1834–35 he assisted Professor Peirce in the instruction of the College classes in mathematics. In 1835-36 he was Proctor and Instructor in mathematics, and during a part of the year he conducted the morning and evening services in the College Chapel in place of the regularly officiating clergyman. In 1836–37 he was Tutor in Mathematics and Lecturer in Natural Philosophy, taking the work of Professor Farrar, whose failing health had led him to resign, and in 1838 he definitely succeeded Professor Farrar as Hollis Professor of Mathematics and Natural Philosophy. The active duties of this office Professor Lovering discharged without assistance for the unprecedented term of fifty years and on resigning in 1888 he was appointed by the Corporation of the University Hollis Professor Emeritus, and thus continued his connection with the institution until his death, — in all, from 1834 to 1892, a period of fifty-eight years, thus exceeding by three years the term of Tutor Flynt (1699-1754), hitherto regarded as the College Nestor.

It must have been a severe ordeal to a young man to succeed such a brilliant lecturer as Professor Farrar; but the event showed that, although a lecturer of a very different type, Professor Lovering's instruction was no less effective than that of his celebrated and popular predecessor. Professor Lovering delivered nine courses of twelve lectures each before the Lowell Institute, and the first four of these, given at the Odeon on Federal Street between 1840 and 1844, the writer attended, and remembers distinctly how instructive and popular they were. Professor Lovering had great clearness of thought and singular definiteness and felicity of expression. He was apt in illustration, and a quiet humor often enlivened what would have been otherwise a dry demonstration. He gave most careful attention to the mechanical preparation of his lectures, and his experiments rarely failed of success. Besides his regular college lectures, during term time always one and usually two a week for a long period of years, and the lectures at the Lowell Institute above referred to, Professor Lovering gave shorter courses at the Smithsonian Institution in Washington, the Peabody Institute of Baltimore, and the Charitable Mechanics'

Institution of Boston, and one or more lectures in many towns and cities of New England.

The wonderful clearness and elegance of exposition so conspicuous in Professor Lovering's lectures appeared also in his monographs and popular essays on scientific subjects. These are very numerous, and are models of scientific style. They are scattered through various serial publications, and are probably known to but few of the present generation; but they represent his very best work, and in justice to his memory they ought to be collected and reprinted. Besides their intrinsic value as the literary work of a very successful teacher, they are valuable material for the history of science. Professor Lovering's long career covers a period of wonderful development in all departments of physics, not simply in the discovery of new facts, but also in the change of aspect under which the old facts are regarded. Our late colleague was a broad scholar, not only familiar with the past history of every branch of his subject, but also accustomed to look at facts from all sides. If a student who had fallen into the rut of a system went to him with a difficulty, — perhaps insuperable on that theory, — he would surmount the difficulty by taking the man out of the rut, and thus enabling him to look at the facts from a different point of view. How different would be our judgment of the alternating phases in the past history of science, — of the labors of the alchemists, for example, — if we could only see the facts as our fathers necessarily regarded them; and the most striking feature of Professor Lovering's essays is the circumstance that the point of view from which he writes is made so clear. Moreover, a comparison of the earlier essays with the later shows how the point of view changed, and that the author, acute scholar as he was, had closely followed the change.

The following contemporary notices fully justify the writer's estimate of these occasional essays, which are enumerated in the catalogue of his publications at the end of this notice. A scholar of high scientific eminence has recently written of these essays, that they impressed him as few others had ever done. "It will surprise him to know it; yet it is true that the ideas then presented, and with an elegance worthy of their breadth and power, affected the whole tenor and tendency of my thoughts, and thus of my subsequent life." And he compares the style of parts of them with that of the most classic passages in Babbage's Ninth Bridgewater Treatise.

So also Mr. R. W. Emerson published the following notice in "The Dial": "We rejoice in the appearance of the first number of this quarterly journal edited by Professor Peirce. Into its mathematics we have not ventured; but the chapters on Astronomy and Physics we read with great advantage and refreshment. Especially we thank Professor Lovering for the beautiful essay on the 'Internal Equilibrium and Motion of Bodies,' which is the most agreeable contribution to scientific literature which has fallen under our eye since Sir Charles Bell's work on the hand, and brings to mind the clear, transparent writings of Davy and Playfair."

Professor Lovering was not a writer of books, but he was an editor of very large experience. He was co-editor with our late colleague, Professor Benjamin Peirce, of the "Cambridge Miscellany of Mathematics, Physics, and Astronomy," published at Cambridge in 1842 and 1843, and devoted to pure and applied mathematics. He edited fifteen volumes of the Proceedings of the American Association for the Advancement of Science, also six volumes of the Memoirs and three volumes of the Proceedings of this Academy, and earlier, in 1842, a new edition of Farrar's Electricity and Magnetism. In 1873 he was the President for the year of the American Association, and in his reception address at Portland he said: "Few of us can aspire to the honor of being discoverers of the laws of nature in the highest sense of that phrase. But no one, however humble his capacities, or however limited his opportunities, who labors for science, will fail to advance it." This well expresses the attitude of our colleague towards his profession. He was not a born investigator, but one whose path in life was determined by force of circumstances, rather than by natural predilections. He was primarily a scholar, and the great service which he rendered to science was that of a scholar and a teacher, and not that of an experimenter. At the present day, courses of research in all departments of study are the latest fad at many of our higher institutions of learning; but excepting always the few highly favored men of the race to whom an unusual scientific insight has been given, it may be a question whether the broad scholar does not exert a greater influence on the advancement of knowledge than the average specialist.

But although Professor Lovering seems to have had little inclination to undertake original experimental investigation in Physics, he did a very large amount of work in observing and correlating facts. He was associated with the late Professor William C. Bond in the management of the primitive astronomical observatory first located at Cambridge in the dwelling-house still remaining on the corner of Quincy and Harvard Streets, and there took part in that concerted onset on the problem of the earth's magnetism instituted by Humboldt and Gauss, and continued throughout the British Empire for several years under the direction of the Royal Society of London. An appeal was made to various academies and men of science in this country to co-operate in the work, and the appeal was responded to by the Magnetic Observatory at Philadelphia under the care of the late Professor Bache, and by the American Academy of Arts and Sciences in Boston, who supplied the Cambridge Observatory with the requisite instruments. The plan of the Royal Society involved, besides frequent regular daily observations, an almost continuous watch on the magnetic needle during one day of each month. On these days, called term days, observations were made every five minutes on three different instruments, day and night. The chief burden of all this work fell on Professor Lovering, although he was greatly assisted, not only in the observations themselves, but also in their reduction and in the mathematical discussion of the results, by Professors Bond and Peirce and a few competent undergraduates. Of these last, the late Thomas Hill, afterward President of Harvard College, and Benjamin A. Gould, the present distinguished astronomer, deserve special mention.

Professor Lovering's experience in this famous magnetic campaign must have familiarized him with the magnetic disturbances accompanying the auroral discharge, and thus led him to discuss the mooted question of the periodicity of the aurora. His study of this problem was the most considerable work of his life. It involved the collating and discussing of an immense number of more or less indefinite observations, and the mere presentation of the result of this long and laborious investigation occupies over 350 pages of the quarto Memoirs of this Academy, New Series, Vol. X. Part I. In this memoir, Professor Lovering clearly defined the secular periods of the aurora, and also showed that no apparent connection could be traced between the secular periodicity of the aurora and the secular changes of the earth's magnetism, the periods of sun-spots, fire-balls, or earthquakes, or any other secular changes with which the aurora had been associated by various physicists. As he writes in this memoir, "A lesson of caution against hasty conclusions on subjects of such complexity may be drawn from the fact, that whereas Boné favored the conclusion that the aurora goes hand in hand with the earthquake, and whereas

Wolf had decided, though from data afterwards acknowledged to be insufficient, that years rich in sun-spots corresponded to years rich in earthquakes, Kluge, from a more searching examination and the use of larger materials, finds a periodicity for earthquakes as long as that which governs the sun-spots and magnetic disturbances, but with maxima and minima reversed." We quote this as an indication of our colleague's judgment and caution in the discussion of observations, and although the investigation did not lead to the discovery of unsuspected relations, yet the negative results reached were of the greatest importance, and the memoir just quoted may be referred to in our transactions with pride, as an example of great thoroughness in the collection of materials, and of remarkable freedom from bias in the discussion of results.

Between 1867 and 1876 Professor Lovering was connected with the United States Coast Survey, and had charge of the computations for determining differences of longitude in the United States, and across the Atlantic Ocean, by means of the land and cable lines of telegraph. The most important and interesting portion of the work which he did in this connection is discussed in a paper "On the Determination of Transatlantic Longitudes by Means of the Telegraphic Cables communicated to the Academy, January 29th, 1873," by permission of the Superintendent of the Survey, and published in the Memoirs, New Series, Vol. IX. page 437.

As might be expected from the character and direction of his scientific work, Professor Lovering had marked executive ability, and in all such relations he was in the highest degree methodical, accurate, and just. During 1853–54 and from 1857 till 1870 he was Regent, then the second executive officer of Harvard College. During this period he kept with his own hands such full and accurate accounts of the merits and demerits of each undergraduate that the Faculty could make his reports the basis of action with entire confidence, while at the same time in dealing with the students he showed such just discrimination and kindly appreciation that he gained their universal confidence and esteem.

When the Jefferson Physical Laboratory was opened, in 1884, Professor Lovering was appointed its "Director," and during the four years of his administration made "Annual Reports" of its activities. To this laboratory he carried the very large and valuable collection of philosophical apparatus which he had gradually accumulated during his long period of service as Hollis Professor. Mr. Lovering took great pleasure and a just pride in this collection. When he entered upon his office, there was already in the possession of his department a no inconsiderable number of philosophical instruments, some of which had a real historical interest, but they did not meet the requirements of a more modern science. Only a small annual appropriation could be obtained for the expenses of his lectures; but by carefully husbanding the resources, and doing all the mechanical work with his own hands, he was able from time to time not only to purchase the indispensable articles, but also to procure all the novelties as they appeared. He judiciously used his large knowledge and judgment in the original selection, and by constant watchfulness prevented the apparatus from deteriorating, and thus during his long term of service he brought together one of the most complete cabinets of physical apparatus in this country. Nothing delighted him more than some new mode of illustrating a recondite principle in a striking way, and every year, at the meeting of the old Scientific Club of Cambridge he would delight his associates also by bringing forward and explaining some such piece of apparatus, and he rose to the highest point of enthusiasm when he made it to appear that the paradoxes of science were no paradoxes at all, but the necessary unfoldings of fundamental laws.

Besides his uninterrupted work for the College, Professor Lovering discharged other executive duties in which he exhibited his usual faithfulness and good judgment. From 1854 to 1873 he was the Permanent Secretary of the American Association for the Advancement of Science, — an office which requires an unusual amount of executive skill, besides tact and affability. On the Permanent Secretary devolve the arrangements for the annual meeting, the collection and disbursement of the funds, and the publication of the yearly volume of Proceedings. It is all important that he should commend the Association to the successive communities where it meets, and commend himself to the local committees. All this service Professor Lovering rendered with great success, and carried the society through the disintegrating period of the Civil War, when its continued life seemed impossible, and so skilfully managed its finances as not only to print a volume of Proceedings every year, but also to leave in the treasury at the end of his term of office a valuable stock of publications and a goodly cash balance. On resigning this office, Mr. Lovering was elected President of the Association, and served as such at the Portland meeting of 1873. Both his reception and his retiring addresses were admirable in thought as well as in spirit, and are excellent examples of the best use of idealism in science.

In the first of these he said: "It is impossible for the man of science to serve two masters, the Kingdom of Nature and Mammon. It is a dangerous thing for him to be thinking of the utility of his discoveries, or of the pecuniary profit which may be made out of them." And in the second he adds: "Science is not destructive, but progressive; while its theories change, the facts remain. Its generalizations are widening and deepening from age to age. We may extend to all the theories of physical science the remark of Grote which Challis quotes in favor of his own: 'Its fruitfulness is its correctibility.' Instead of being disheartened by difficulties, the true man of science will congratulate himself, in the words of Vauvenargues, that he lives in a world fertile in obstacles. Immortality would be no boon if there were not something left to discover, as well as to love."

Professor Lovering was also for some years one of the trustees of the Tyndall Fund for the endowment of research in physics, and during the last few years of his life he was one of the Trustees of the Peabody Museum of American Archæology and Ethnology.

Professor Lovering was long and intimately associated with our Academy. He was elected Fellow on January 30, 1839, and the only surviving member on our list whose election antedates his is our honored colleague, Dr. O. W. Holmes. From 1851 to 1872 he was a member of the Committee of Publication. From 1847 to 1868, and again from 1878 to his death, he was a member of the Rumford Committee, and during the greater portions of these periods its chairman, directing its deliberations and inspiring a proper caution in the expenditure of the funds as well as in the bestowal of the medals under its charge. From 1852 to 1863, and again from 1865 to 1868, he held a place on the Council of the Academy by annual election, and during the rest of his life *ex officio*. From 1869 to 1873 he was Corresponding Secretary. From 1873 to 1880 he was Vice-President, and from 1880 to his death President. Thus our late colleague's membership has covered fifty-three of the one hundred and twelve years which have passed since the Academy was incorporated, under the Presidency of Governor James Bowdoin, in 1780. During this long period, nearly one half of its whole history, Professor Lovering through his force of character and commanding knowledge exerted a controlling influence in its affairs. For many years he superintended its publication, and the prosperity of our society during the second half-century of its life was in no small measure due to his fostering care. Mr. Lovering was also a member of the National Academy of Sciences, of the American Philosophical Society of

Philadelphia, of the California Academy of Sciences and of the Buffalo Historical Society. In 1879 he received from his Alma Mater the degree of Doctor of Laws.

Professor Lovering was pre-eminently a social man, and any notice of him would be incomplete that did not allude to this genial phase of his character. He was one of the few men who could hold his opinions and maintain his position without personal animosity or unfriendly feeling, could favor without partisanship, could oppose without bitterness. He never would quarrel, and, as he once said to the writer, it takes two to make a quarrel and the other man only counts one. Besides a frank cordiality and kindliness of greeting which made him very accessible, he had a fund of dry humor, which not only enlivened intercourse; but often gave force to an argument. Not unfrequently in meetings of the College Faculty he would turn a stupid debate, and exhibit a question in its real absurdity, by a witty remark. There was also a straightforwardness, integrity, and truthfulness about his intercourse which inspired confidence and warmly attached him to his friends. He was perfectly just and singularly free from bias, and in any question involving rectitude or faithfulness you could always count on him. He was faithful to every duty, and conscientiously discharged every obligation. He rarely, if ever, missed an appointment, and whatever he undertook, however unimportant, he did with all his might.

Besides attending and keeping up the spirit of the Cambridge Scientific Club above referred to, of which he was one of the original members, he was uniformly present at the meetings of the Thursday Evening Club in Boston, and often contributed to its proceedings. He very greatly enjoyed those meetings, and his communications were always esteemed by the members. He had the happy faculty of popularizing a subject without degrading it. He could present a problem so that his audience could follow as far as he led, and understand why he did not attempt to lead them further. His discourse was always free from trivialities or redundances, and his hearers could appreciate the grandeur of the mountain all the better because they had not made a fruitless attempt to climb it.

It was a very fitting tribute to Professor Lovering's warm social nature, that at the close of his active duties, in 1888, a banquet should be held in honor of his fifty years' service. It was the spontaneous offering of classmates, associates, pupils, and friends, and it afforded him the highest satisfaction. Besides the social pleasures and warm eulogiums of the time, the occasion led to two enduring memorials; first, a silver teapot, (copied from one formerly used by Tutor Flynt, now in the possession of Dr. O. W. Holmes,) which will be handed down as an heirloom in his family; and, secondly, a portrait painted by Linden Smith, which will hold his likeness on the walls of Memorial Hall.

Professor Lovering was married in 1844 to Sarah Gray Hawes of Boston, and his wife, with two sons and two daughters, survive him. Since retiring from active work, he has passed four serene and happy years. He several times said to the writer, " You don't know what a pleasure it is to be relieved from stated duties, and to have full command of your time. I have plenty to do, and never have an idle moment." Through great prudence and thrift he had laid aside a sufficient competency to relieve him from all pecuniary anxieties and his friends had hoped that he might long pass the full term of fourscore years. His wonderful vitality and singular immunity from disease encouraged this hope. He said to his classmate, Dr. Morrill Wyman, who had been his family physician for half a century, and who was feeling his pulse during his last illness, "No one has felt my pulse before since I was a child." But it was not to be. A severe cold complicated by the prevailing epidemic attacked the heart, and the end came in the early morning of January 18, 1892. The change was peaceful, and without pain.

The following catalogue of Professor Lovering's publications is taken from the College Class-book entitled "Memorials of the Class of 1833 of Harvard College, prepared for the Fiftieth Anniversary of their Graduation by the Class Secretary, Waldo Higginson"; and preceding the catalogue the Secretary states that it was furnished by Professor Lovering. The present writer has only added a few items of papers which to his knowledge have appeared since.

1. An Account of the Magnetic Observations made at the Magnetic Observatory of Harvard College. In Two Parts. (Memoirs of the American Academy, vol. ii., 1846.)
2. On the Secular Periodicity of the Aurora Borealis. (Ibid., vol. ix.)
3. On the Determination of Transatlantic Longitudes by Means of the Telegraphic Cables. (Ibid., 1867.)
4. Catalogue of Auroras observed, mostly at Cambridge, after 1838. (Ibid., vol. x., 1868.)
5. On the Periodicity of the Aurora Borealis. In Two Parts. (Ibid., with plates, 1868.)

6. On the Causes of the Difference in the Strength of Ordinary Magnets and Electro-magnets, of the same Size and Shape. (Proceedings of the American Academy, vol. ii.)
7 On the Law of Continuity. (Ibid.)
8. On the Aneroid Barometer. (Ibid.)
9. Electrical Experiment. (Ibid., vol. iv.)
10. On the Connection of Electricity with Tornadoes. (Ibid., vol. ii.)
11. On Coronæ and Halos. (Ibid.)
12. On the Spectroscope. (Ibid., vol. iii.)
13 On the Bioscope. (Ibid.)
14. Apparatus for Rapid Rotations. (Ibid.)
15 Shape of Luminous Spots in Solar Eclipses. (Ibid.)
16. Notice of the Death of John Farrar. (Ibid.)
17 Notice of the Death of Melloni. (Ibid.)
18. New Apparatus and Experiments in Optics and Acoustics. (Ibid.)
19. Arago's Opinion of Table-Moving. (Ibid.)
20. On Fessel's Gyroscope. (Ibid.)
21. Apparatus to regulate the Electric Light. (Ibid.)
22. Does the Mississippi River flow Up-hill? (Ibid.)
23. Report on Hedgcock's Quadrant. (Ibid)
24. On the Boomerang. (Ibid., vol. iv.)
25. Report on Meteorological Observations. (Ibid.)
26. On the Ocean Cable. (Ibid.)
27. On the Polarization of the Light of Comets. (Ibid.)
28. Report on the Polar Expedition of Dr. I. I. Hayes. (Ibid.)
29. On Records of the Aurora Borealis. (Ibid)
30. First Observations on the Aurora in New England. (Ibid.)
31. Notice of the Death of Biot. (Ibid., vol. ii.)
32. On the Velocity of Light and the Sun's Distance. (Ibid.)
33. Notice of the Death of O. M. Mitchell. (Ibid.)
34. On the Optical Method of studying Sound. (Ibid., vol. vii.)
35. On the Periodicity of the Aurora Borealis. (Ibid., vol. viii., 1873.)
36. On the French Republican Calendar. (Ibid.)
37. Application of Electricity to the Motion of Tuning-Forks. (Ibid.)
38 On Optical Meteorology. (Ibid.)
39. On Transatlantic Longitudes. (Ibid.)
40. Notice of the Death of William Mitchell. (Ibid.)
41. Notice of the Death of Faraday. (Ibid.)
42. Notice of the Death of David Brewster. (Ibid.)
43. Notice of the Death of J. W. F. Herschel. (Ibid.)
44. Notice of the Death of Christopher Hansteen. (Ibid., vol. ix.)
45. Notice of the Death of Auguste A. de la Rive. (Ibid.)
46. Notice of the Death of James Walker. (Ibid., vol. x.)
47. Notice of the Death of Joseph Winlock. (Ibid., vol. xi.)
48. Notice of the Death of Alexis Caswell. (Ibid., vol. xii.)

49. Notice of the Death of John H Temple. (Ibid., vol. xiii.)
50. Notice of the Death of Joseph Henry. (Ibid., vol. xiv.)
51. Notice of the Death of H. W. Dove. (Ibid., vol. xv.)
52. Address as President on presenting the Rumford Medal to J. Willard Gibbs. (Ibid., vol. xvi.)
53. Anticipations of the Lissajous Curves. (Ibid.)
54. Notices of the Deaths of Richard H. Dana, of Edward Desor, and of John W. Draper. (Ibid., vol. xvii.)
55. Notice of the Death of Sir Edward Sabine. (Ibid., vol. xix.)
56. Address of the President on presenting the Rumford Medal to H. A. Rowland. (Ibid.)
57. Address as President on presenting the Rumford Medal to S. P. Langley. (Ibid., vol. xxii.)
58^a. Notice of the Death of Gustav Robert Kirchhoff. (Ibid., vol. xxiii.)
58^b. Address as President on presenting the Rumford Medal to A. A. Michelson. (Ibid., vol. xxiv.)
58^c. The "Mécanique Céleste" of Laplace, and its Translation by Bowditch. (Ibid., vol. xxiv.)
59. On the Electro-dynamic Forces. (Proceedings of the American Association for the Advancement of Science, vol. ii.)
60. On a Curious Phenomenon relating to Vision. (Ibid.)
61. On a Singular Case of Interference in the Eye itself. (Ibid., vol. vii.)
62. On a Modification of Soleil's Polarizing Apparatus. (Ibid.)
63. On the Australian Weapon called the Boomerang. (Ibid., vol. xii.)
64. On the Optical Method of studying Sound. (Ibid., vol. xvi., 1868.)
65. On the Periodicity of the Aurora Borealis. (Ibid.)
66. Sympathetic Vibrations between Tuning-Forks and Stretched Cords. (Ibid.)
67. On Methods of illustrating Optical Meteorology. (Ibid., vol. xix., 1871.)
68. On Sympathetic Vibrations. (Ibid., vol. xxi., and Journal of the Franklin Institute, May, 1873.)
69. Addresses as President at the Portland Meeting of the American Association for the Advancement of Science. (Proceedings of the A. A. A. S., vol. xxiii.)
70. On a New Way of illustrating the Vibrations of Air in Organ-Pipes. (Ibid.)
71. Address as Retiring President. (Ibid.; republished in the Popular Science Monthly, American Journal of Science, and the London Philosophical Magazine.)
72. On a New Method of measuring the Velocity of Electricity. (Proceedings of the American Association for the Advancement of Science, vol. xxiv.; also Journal de Physique, tome vi.)
73. Shooting Stars (American Journal of Science, vol. xxxv.)
74. The American Prime Meridian. (Ibid., N. S., vol. ix., 1850.)

75. The Aneroid Barometer. (Ibid.)
76. On the Velocity of Light and the Sun's Distance. (Ibid., N. S., vol. xxxvi.)
77. Melloni's Researches on Radiant Heat. (American Almanac, 1850.)
78. Animal Electricity. (Ibid., 1851.)
79. Recent Discoveries in Astronomy. (Ibid., 1852.)
80. Comets. (Ibid., 1853.)
81. Atmospherical Electricity. (Ibid., 1854 and 1855.)
82. Lightning and Lightning-Rods. (Ibid., 1856.)
83. Terrestrial Magnetism. (Ibid., 1857.)
84. Theories of Terrestrial Magnetism. (Ibid., 1859.)
85. On the Boomerang. (Ibid., 1859.)
86. On the Aurora Borealis and Australis. (Ibid., 1860.)
87. On Meteorology. (Ibid., 1861.)
88. On the Pressure of the Atmosphere and the Barometer. (Ibid., 1862.)

REVIEWS, ETC.

89. Guyot's Physical Geography. (Christian Examiner, vol. xlvii.)
90. Humboldt's Cosmos. (Ibid., vol. xlviii.)
91. Scepticism in Science. (Ibid., vol. li.)
92. Spiritual Mechanics. (Ibid., vol. lv.)
93. Thompson and Kaemtz on Meteorology. (North American Review, vol. lxxi.)
94. Elementary Works on Physical Science. (Ibid., vol. lxxii.)
95. Michael Faraday. (Old and New, vol. i.)
96. Reports on Lighthouses. By Benjamin Peirce and Joseph Lovering. (Journal of the Franklin Institute, vol. xviii.)
97. On the Internal Equilibrium and Motion of Bodies. (Cambridge Mathematical Miscellany, vol. i.)
98. On the Application of Mathematical Analysis to Researches in the Physical Sciences. (Ibid.)
99. Encke's Comet. (Ibid.)
100. The Divisibility of Matter. (Ibid.)
101. Boston and Science. (Memorial History of Boston, vol. iv.)
102. Article on the Telegraph. (American Cyclopædia, last edition.)
103. Address at the Dedication of the Mural Monument to the Memory of Dr. James Walker, in the Harvard Church, Charlestown.
104. Notice of the Death of F. A. P. Barnard. (Proceedings of the American Academy, vol. xxiv.)

SUBJECTS OF LECTURES AT THE LOWELL INSTITUTE.

1840–41. Electricity and Magnetism.
1841–42. Mechanics.
1842–43. Astronomy.

1843-44. Optics.
1845-46. Astronomy.
1853-54. Electricity and Magnetism.
1859-60. Astronomy.
1865-66. Light and Sound.
1879-80. Connection of the Physical Sciences.

GEORGE HINCKLEY LYMAN.

Dr. George Hinckley Lyman, Resident Fellow of the Academy, was born in Northampton, Mass., July 17, 1819, the son of Jonathan Huntington and Sophia (Hinckley) Lyman. He was educated at the famous Round Hill School in Northampton; but on account of ill health he was obliged to pass several years in Ohio and other Western States before beginning his professional studies in the University of Pennsylvania, at Philadelphia, where he took his degree of M. D. in 1843. Wishing to qualify himself thoroughly for the practice of his profession, he devoted more than the usual time to advanced study and clinical observation in the great hospitals of Europe, before returning to establish himself in Boston. Here he at once attracted attention through the publication of two Essays, — on " Non-Malignant Diseases of the Uterus," and on the " History and Statistics of Ovariotomy," — which had gained prizes offered by Medical Societies as being valuable contributions to the knowledge of the profession, and marked by the wise discrimination and candor shown in the discussion of their subjects, to which was added the charm of clearness and elegance of style.

The early promise thus given of Dr. Lyman's career was amply fulfilled. His thorough training, quickness of observation, and good judgment, with his faithful ministrations and ready sympathy, invited and retained the confidence of his patients of high or low degree.

But his success as a physician did not make him heedless of the claims of his country. At the outbreak of the Civil War, in 1861, he volunteered his services to Governor Andrew of Massachusetts, and, in co-operation with Surgeon General Dale, become his efficient adviser in the organization of a suitable surgical and ambulance service for the departing troops. Nor did he linger in the rear. As these went to the front, he went to share their dangers and alleviate their sufferings.

Standing first on the list of candidates examined by the Medical Army Board of Washington, he outranked during the war all the appointees from civil life. He was soon assigned as Medical Director of